Gunnery Department
MLRS Division

"Standards Start Here"

MLRS DELIVERY OF FIRES

The Mission of the Field Artillery is to…

DESTROY

SUPPRESS

the enemy by cannon, ROCKET and MISSILE fires and to help integrate all fire support assets into combined arms operations.
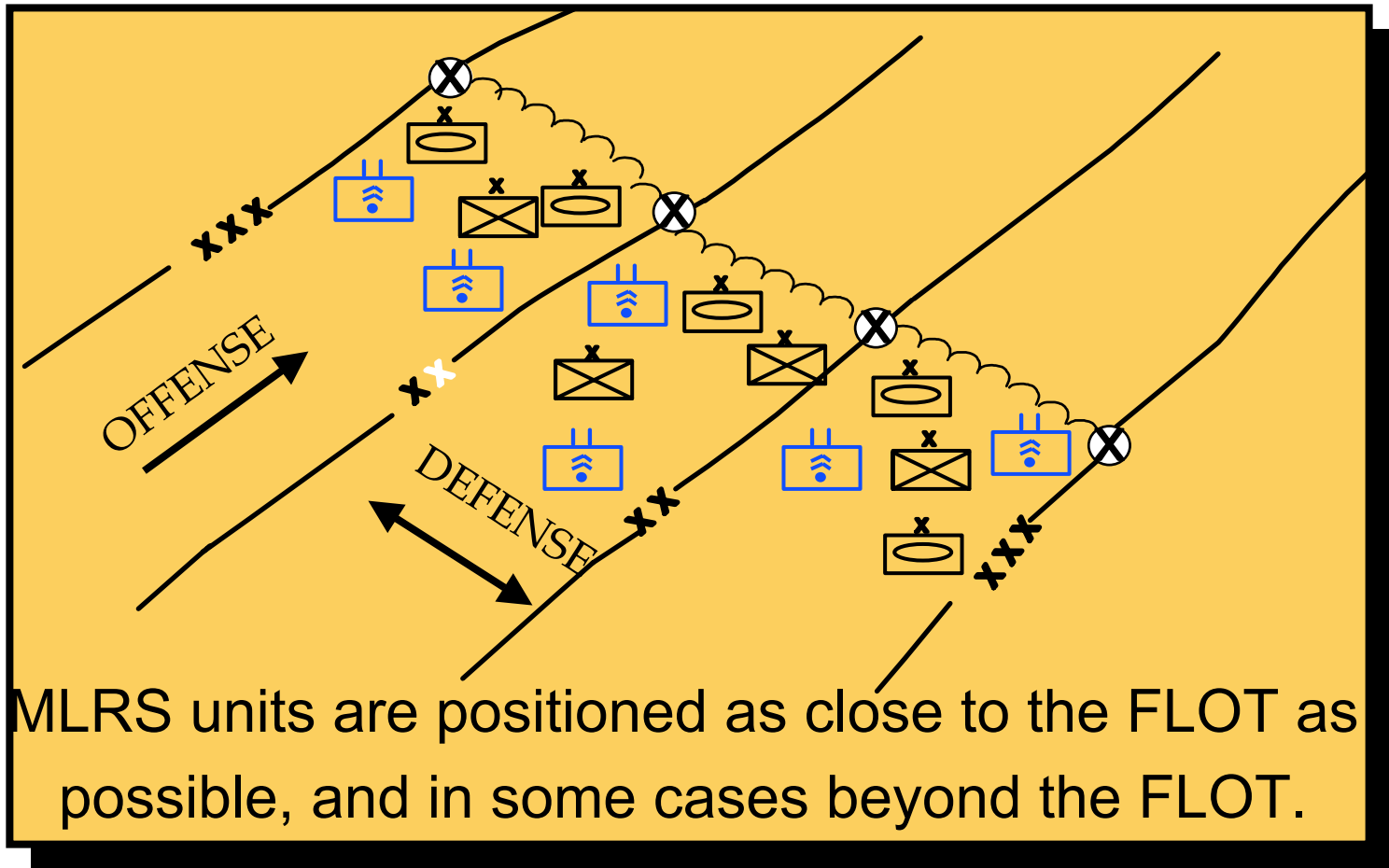
- Identify requirements to safely deliver MLRS fires
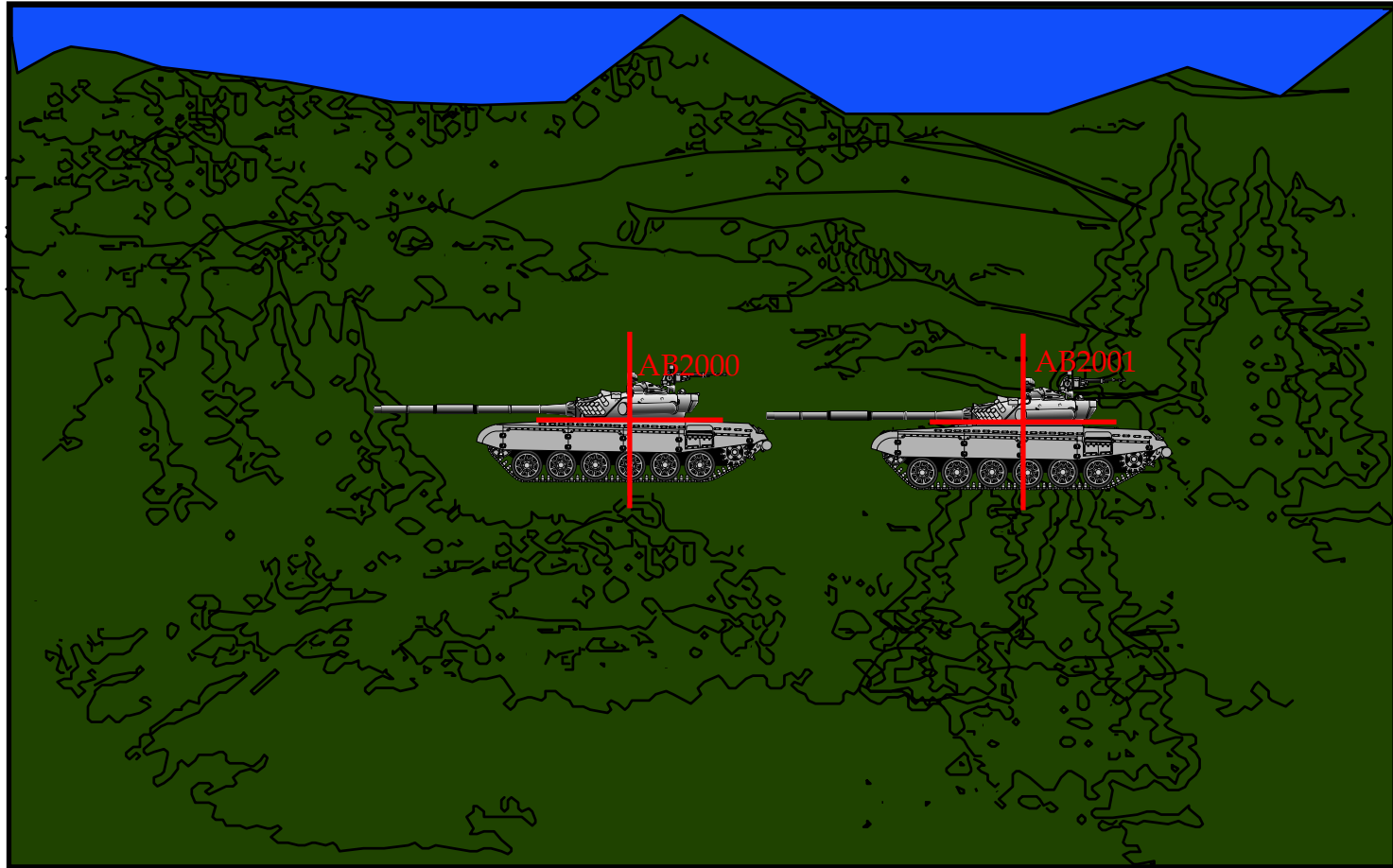
Learning Activities

- Identify the MLRS Targeting Process
- Identify the Levels of Intensity
- Determine requirements in Launcher Location
- Identify Tactical Response Posture methods
- Demonstrate knowledge in Meteorological Requirements
- Identify requirements for Fire Mission Processing
- Identify MLRS Safety Procedures

Targeting Process

Corps Area of Operations

OFFENSE

DEFENSE

MLRS units are positioned as close to the FLOT as possible, and in some cases beyond the FLOT.
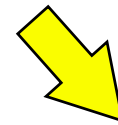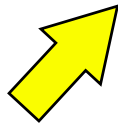
Targeting Process

D3A

DECIDE

ASSESS

DETECT

DELIVER

Decide

- Overall focus/sets intell collection priorities.
- What delivery system to use.
  - Avail of other wpns sys (manned aircraft)
  - Range to target (munitions availability)
- Which targets to attack (TSS,HPTL,AGM).

FM 6-20-10
ST 6-60-30

Detect

- What to look for (PIR)
- Where to look (NAI)
- What to look with (TA)
- Where to attack (TAI)

Deliver

- Which weapon system
- Determine desired effects.

Destroy!
Neutralize!
Suppress!

FM 6-20-10
ST 6-60-30

Assess

Final verification of target.

Targeting Process
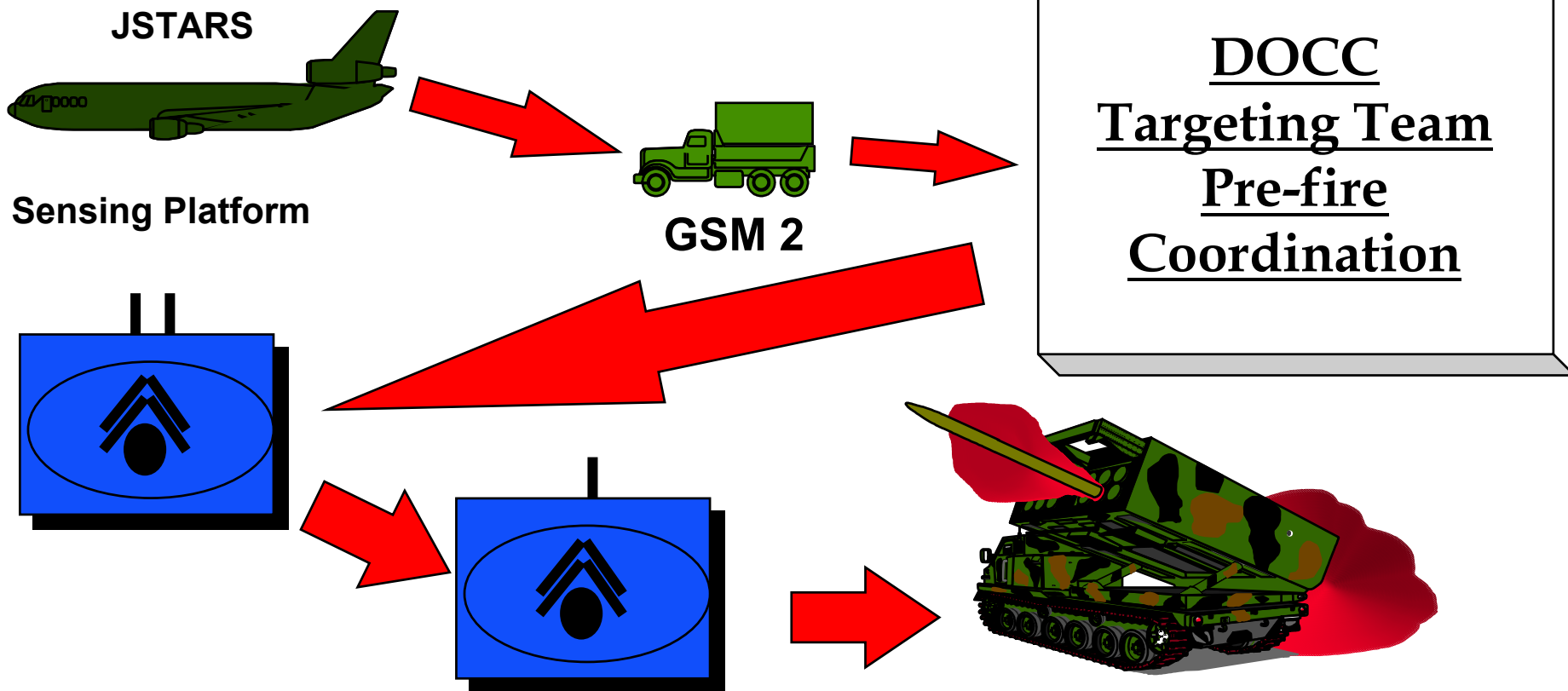
- Centralized
- Decentralized

MLRS Delivery of Fires
Targeting Process
Centralized Execution

XXX

JSTARS

Sensing Platform

GSM 2

DOCC
Targeting Team
Pre-fire
Coordination

FM 6-20-10
ST 6-60-30

Decentralized Execution

JSTARS

Sensing Platform

GSM 2

XXX

DOCC
Targeting Team
Pre fire
coordination
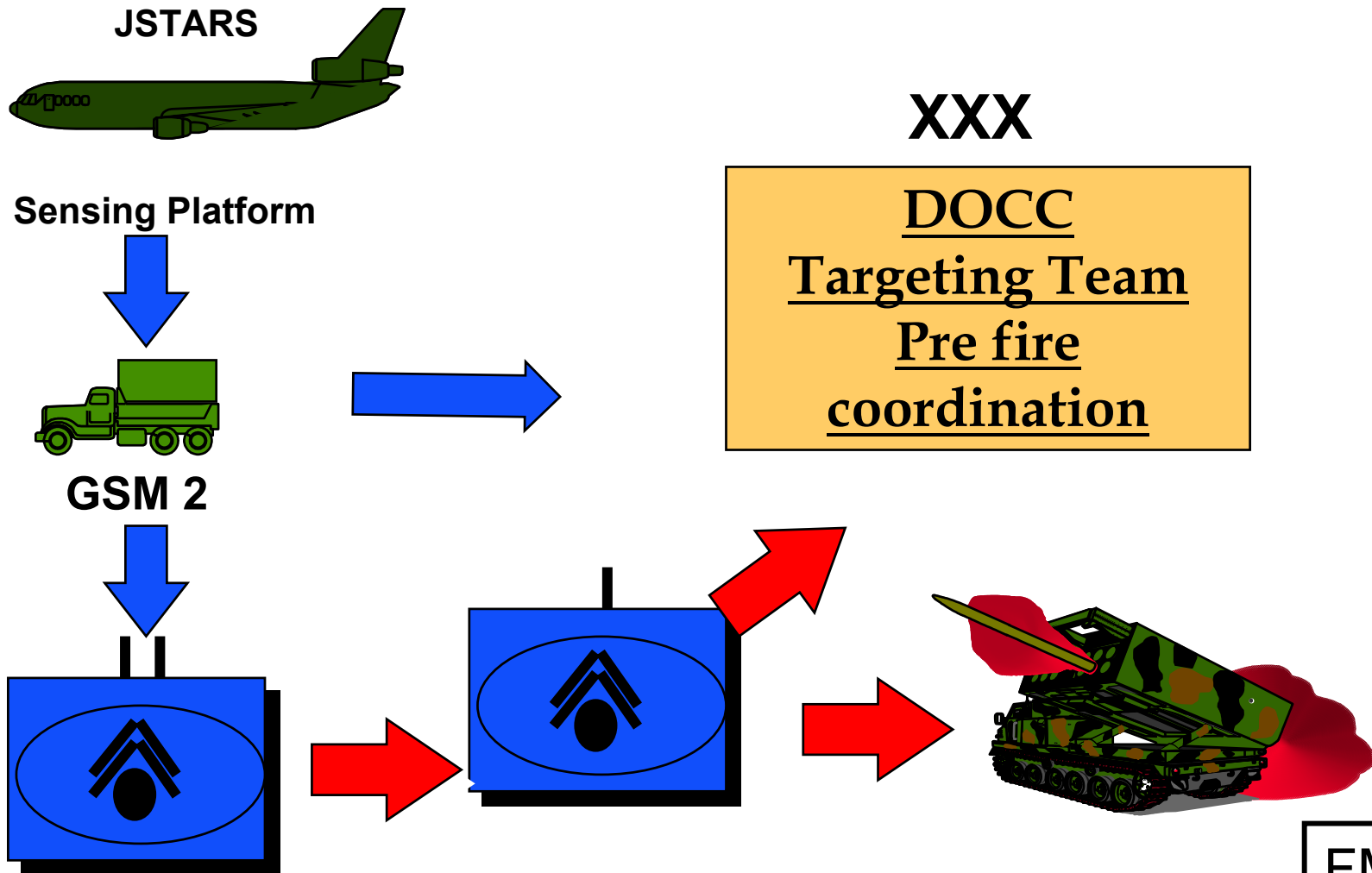
FM 6-20-10
ST 6-60-30

Control of Munitions

(M26/M39)

- Centralized
- Decentralized

Control of Munitions

Missiles (Centralized)

- M39 Army Tactical Missiles (ATACMS)
- Normally fired at targets beyond Division's AO
- Generally fired by corps MLRS BNs
- Controlled by the Corps Artillery

P 5-1

Control of Munitions

Rockets (De-Centralized)

- <u>M26 Tactical Rockets</u>
- Normally fired at targets within Division's AO
- Fired by Divisional MLRS BN/Btry, attached MLRS BN or Reinforcing FA Brigade
- Generally, under the control of DIVARTY

MLRS Delivery of Fires
Targeting Process
Decentralized Execution

Suite of Sensors

JSTARS	UAV
Radar	SOF
LRS-D	ELINT

XXX

CTOC

Targeting Team
AVN   ASOC
FSE   ADA

GSM 2
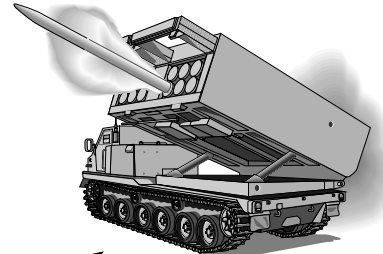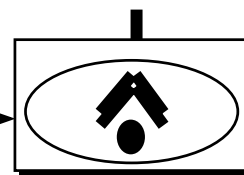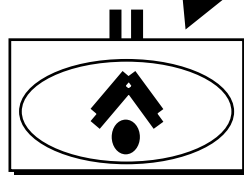
Levels of Intensity

Levels of Intensity

- Levels of Intensity
    - A projection of the anticipated firing rate
    - Aids all leaders in:
        1. Posturing launchers and munitions
        2. Planning ammunition resupply
        3. Sleep plan
- Types: Sustained, Surge, and Peak

Sustained

- Level of effort a committed force can expect for an extended period of time
- Approximately 75% of the time
- Average of 80 rockets fired per launcher

Surge

- Level of effort a committed force can expect when facing a main attack

- Approximately 20% of the time

- Average of 150 rockets fired per launcher

Peak

- Level of effort a committed force can expect during an intense period of time
- Most likely occurs when Reinforcing Artillery
- Approximately 5% of the time
- Average of 195 rockets fired per launcher

Launcher Location

Launcher Location

- PDS Update
- SRP Alignment
- Calibration

PDS Update

- Maintain Accuracy

- Normally done after 6 to 8 km of travel.

- PDS output compared to known survey control point (SCP)

- Calibration constants are not changed

PDS Update

Position and Determining System (PADS)
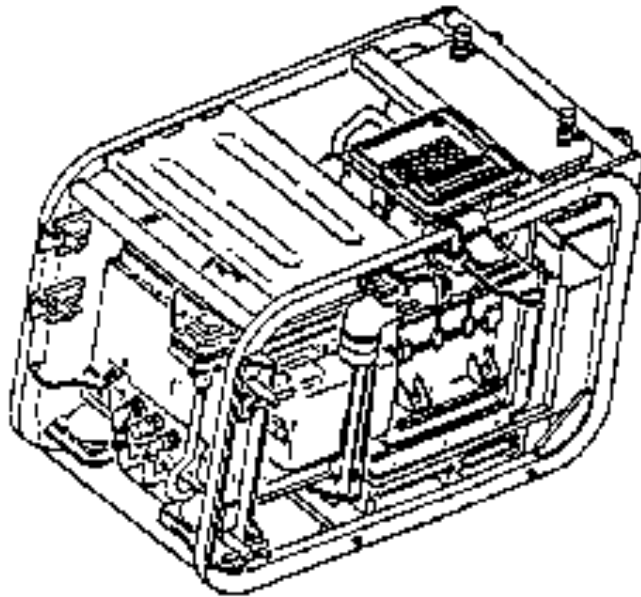
- One PADS per battery

- Determines location and altitude

- <u>Primary means</u> for determining position control

- Survey section controlled through the BOC

PDS Update

Precision Lightweight GPS Receiver (PLGR)

- One PLGR per launcher section
- <u>Secondary</u> means for establishing position control
- Only useful for position control when <u>SPLL is updated at the FP</u>

SRP Alignment

- Orientation of gyro-compass determines
  - Heading
  - Elevation
  - Slope
- Initial uncompensated alignment takes 8 minutes
- Additional stabilization results in a compensated SRP (about 2.5 minutes)

SPLL Slope

ROLL & PITCH

Positive Roll Angle Left Side is Higher
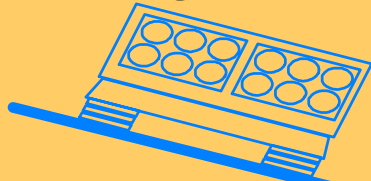
Negative Roll Angle Left Side is Lower
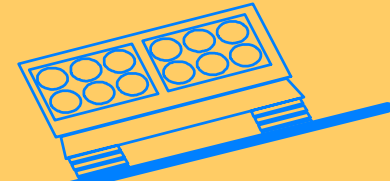
Positive Pitch Front is Higher
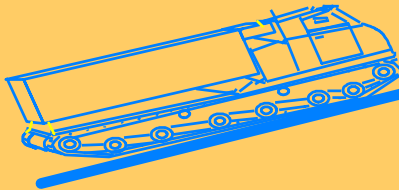
Negative Pitch Front is Lower
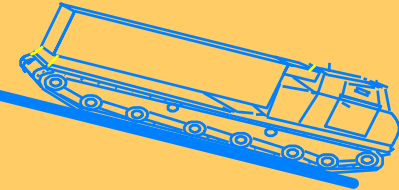
The combined Roll and Pitch Angle should not exceed the carriers limitations of 89 mills or 5 degrees. The system will accept up to 266.7 mils before telling you "Slope to great move vehicle".

SRP Realignment

- Countdown clock alerts crew when to realign the SRP

- Realignment takes 3.5 minutes Launcher stationary; LLM stowed

  - Compensated Realignment

Time Between SRP Alignments

M26 Rocket

UNCOMPENSATED

15:00

COMPENSATED

60:00

M39 Missile

UNCOMPENSATED

11:00

COMPENSATED

28:00

P 4-19

PDS Calibration

• PDS calibration compares the PDS output against two known SCP locations and computes calibration constants

• The constants are then used as the odometer scale factor, azimuth crab angle, and elevation crab angle calibration parameters until the next calibration

PDS Calibration

- Corrects for errors caused by:
  - Differences in track tension
  - By wear of sprockets and track components
- How often?
  - Every 30 Days
  - After SRP/PDS Replacement
  - After major suspension or track drive system maintenance
  - When operating conditions change

PDS Calibration

Required:

• Two SCPs 4-6 KM apart in a straight line distance.

• You should drive the launcher between the two points at a constant speed of 40KPH

Calibration

2. Crew enters and stores SCP 2 location.

3. SRP/PDS automatically computes/evaluates initial calibration constants.

1. Crew enters and stores SCP 1 location.

- Straight line distance
- 4 to 6 kilometers apart
- Constant speed of 40 kph

SCP 1

SCP 2

4. Crew enters and stores SCP 1 location.

5. SRP/PDS automatically computes/evaluates second set of calibration constants, then averages the two sets of constants and stores them.

Calibration Course

SCP 1

SCP 2

- Straight line distance

- 4 to 6 kilometers apart

- Constant speed of 40 kph

- Planned by the OPS Officer as part of the battery survey plan

- Normally centrally located behind the firing platoons

Tactical Response Posture

Weapon Information

- Indicates launchers' readiness to respond to fire missions
  - Directed by Commander
  - Posturing HOT, COOL, or COLD

* See Table 6-1 (P 6-7) for MFOM and AFOM J-codes

Hot Status

- Launcher is fully capable of firing a mission

- Response time 2-6 min depending on:

  - Travel time to Firing Point

  - Launcher lay time (93 Sec for M270)

Cool Status

- Launcher can fire after SRP alignment

- Response time 12-20 min

- Used for temporary break in firing

  - Minor PMCS

  - Class I

  - Refueling

Cold Status

- Launcher is Non-mission capable for:
    - Maintenance
    - PMCS
    - Crew rest
- Response time is a minimum of 30 min

Meteorological Requirements

Identify Meteorological Requirements

Accurate MET

- Launcher FCS uses all lines to compute firing data

- MET message received from Force FA HQs to Bn to Btry to the Launcher

- FDS can interface directly with MDS (heavy divisions) or MMS (light divisions)

Criteria

- Current MET from station within 20 km of Firing Points

- Current MET from nearest station outside of 20 km from Firing Points

- MET over 2 hours, but from station within 20 km of the Firing Points

- Note: 4 hour MET can be used except during transitions

Validation of MET

Preferences

- Current MET from station within 20km

- Current MET from nearest station outside of 20km

- MET over two hours, but from station within 20km

- Note: 4 hour MET can be used except during transitions

COMPUTER MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is TRADOC.

IDENTIFI-CATION	OCTANT	LOCATION $L_aL_aL_a$ or xxx $L_oL_oL_o$ or xxx	DATE	TIME (GMI)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE MB P P P
METCM	Q		YY	$G_oG_oG_o$	G	hhh	d d d
METCM							

ZONE HEIGHTS METERS	LINE NUMBER ZZ	ZONE VALUES			
		WIND DIRECTION (10s M) ddd	WIND SPEED (KNOTS) FFF	TEMPERATURE (1/10 K) TTTT	PRESSURE (MILLIBARS) PPPP
SURFACE	00				
200	01				
500	02				
1000	03				
1500	04				
2000	05				
2500	06				
3000	07				
3500	08				
4000	09				
4500	10				
5000	11				
6000	12				
7000	13				
8000	14				
9000	15				
10000	16				
11000	17				
12000	18				
13000	19				
14000	20				
15000	21				
16000	22				
17000	23				
18000	24				
19000	25				
20000	26				

FROM TO	DATE AND TIME (GMT)	DATE AND TIME (LST)
MESSAGE NUMBER	RECORDER	CHECKED

DA FORM 3677-R, MAY 92   PREVIOUS EDITION OF THIS FORM MAY BE USED UNTIL EXHAUSTED   USAPPC V1.00

DA FORM 3677-R

Indicates a Computer MET

The station altitude in tens of meters

Atmospheric Pressure in Millibars

COMPUTER MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is TRADOC

IDENTIFI-CATION	OCTANT	LOCATION		DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE MB
		$L_a L_a L_a$ or **xxx**	$L_o L_o L_o$ or **xxx**					
METCM	Q			YY	$G_o G_o G_o$	H	hhh	$P_d P_d P_d$
METCM	1	347	984	25	138	4	036	974

Position of MET Station in LAT and LONG to the nearest 10th of a degree

A one digit code representing the duration the MET is valid for

Global Position where the MET was taken

Day of the Month/Greenwich

Greenwich Mean Time: The 1st two digits represent the hour, and the 3rd digit represents the minutes in tenths

Message Heading

- Verify if date and time are current
- Note: GMT is used
- Check met station height
- Identification line and line 00 pressure should be the same

ZONE HEIGHTS METERS	LINE NUMBER ZZ	ZONE VALUES			
		WIND DIRECTION (10s M) ddd	WIND SPEED (KNOTS) FFF	TEMPERATURE (1/10° K) TTTT	PRESSURE (MILLIBARS) PPPP
SURFACE	00	310	004	2923	0974
200	01	250	011	2931	0962
500	02	316	011	2946	0932
1000	03	361	014	2931	0893
1500	04	371	011	2871	0841
2000	05	504	007	2826	0793
2500	06	453	015	2826	0745
3000	07	473	014	2741	0702

Wind Direction in tens of mils

Wind Speed in Knots

Air Temp. to nearest tenth of a degree Kelvin

Message Body

- <u>Question MET when lines change</u>:
  - Greater than 1000 mils in wind direction
  - Greater than 10-15 knots in wind speed
  - Greater than 20 Kelvin in temperature
    <u>and</u>:
  - Atmospheric Pressure does not decrease consistently

Pressure does not decrease gradually

ZONE HEIGHTS METERS	LINE NUMBER ZZ	ZONE VALUES			
		WIND DIRECTION (10s M) ddd	WIND SPEED (KNOTS) FFF	TEMPERATURE (1/10° K) TTTT	PRESSURE (MILLIBARS) PPPP
SURFACE	00	310	004	2923	0974
200	01	250	011	2731	0962
500	02	316	011	2946	0932
1000	03	361	014	2931	0893
1500	04	371	011	2871	0841
2000	05	504	026	2826	0793
2500	06	453	015	2826	0827
3000	07	473	014	2741	0702

Greater than 1000 MILs

15 KNOT Difference

Greater than 20° K Difference

Fire Mission Processing

Computational Procedures

- Tactical fire direction computed via the FDS

- Technical fire direction computed via the FCS on the launcher

  - Computes firing data for all fire missions

  - The EU munitions programs are input from a cassette through a PLU

Fire Plan

- Unit Responsibilities
- System Capabilities
- Target Processing
- Resource Limitations

Battalion Responsibilities

- Link to controlling FA Headquarters
- Fire Direction Net Control Station (NCS)
- Selects battery/platoon to fire
- Transmits targets/fire plans to battery for execution

Battalion FDC

- Tactically controls fires of the battalion
- NCS for the Fire Direction Net(s)
- Primary link with Force FA HQ
- Receives fire plans from Force FA HQ
- Checks for FSCM violations
- Selects platoon to execute fire mission
- Transmits targets to battery FDCs

Battery FDC

- Concerned solely with delivery of fires
- Executes fireplans
- Checks for FSCM violations
- Transmits fire mission to launcher
- Maintains status of launchers

Platoon FDC

- Monitors all traffic between BOC and launchers
- Relays messages and orders
- Maintains ammunition and launcher status
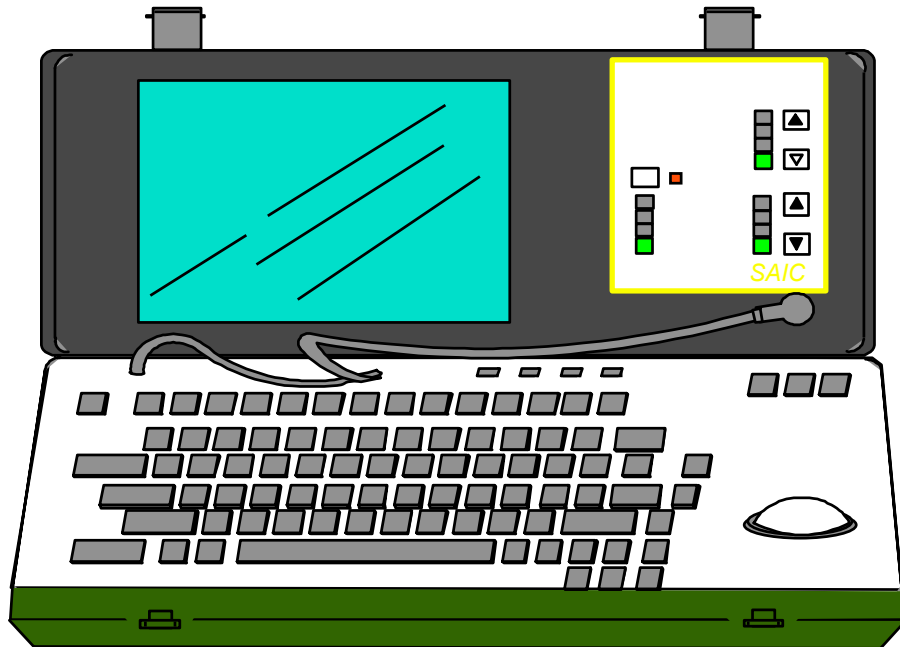- Be prepared to assume Jump BOC

Battery Responsibilities

- Store fire plan until 30 minutes prior to H-hour
- Execute fire plan:
  - Selects launchers to fire. "Rule of thumb" no more than 6 launchers at one time
- Transmit MLRS;CFF to launcher(s) for execution

*See P 5-13 "Fire Plan Change Reaction Times"

Fire Direction System (FDS)

(AN/GYK-37)

FDS Capabilities

- Stores and executes up to 6 fire plans
- Same program hard drive at:
    - Battalion
    - Battery
    - Platoon
- Selects number of aim points
- Selects number of rockets

Target Processing

Target Type
- Volleys Type Targets
- Effects Type Targets

Volleys Type Target

- All rockets aimed at target center

- If no entry, default value is six rockets

Effects Type Targets

- FDS selects number of rockets to fire at a specific number of aim points (maximum of 6 per target)
- Aim point determining criteria:
  - Desired effects
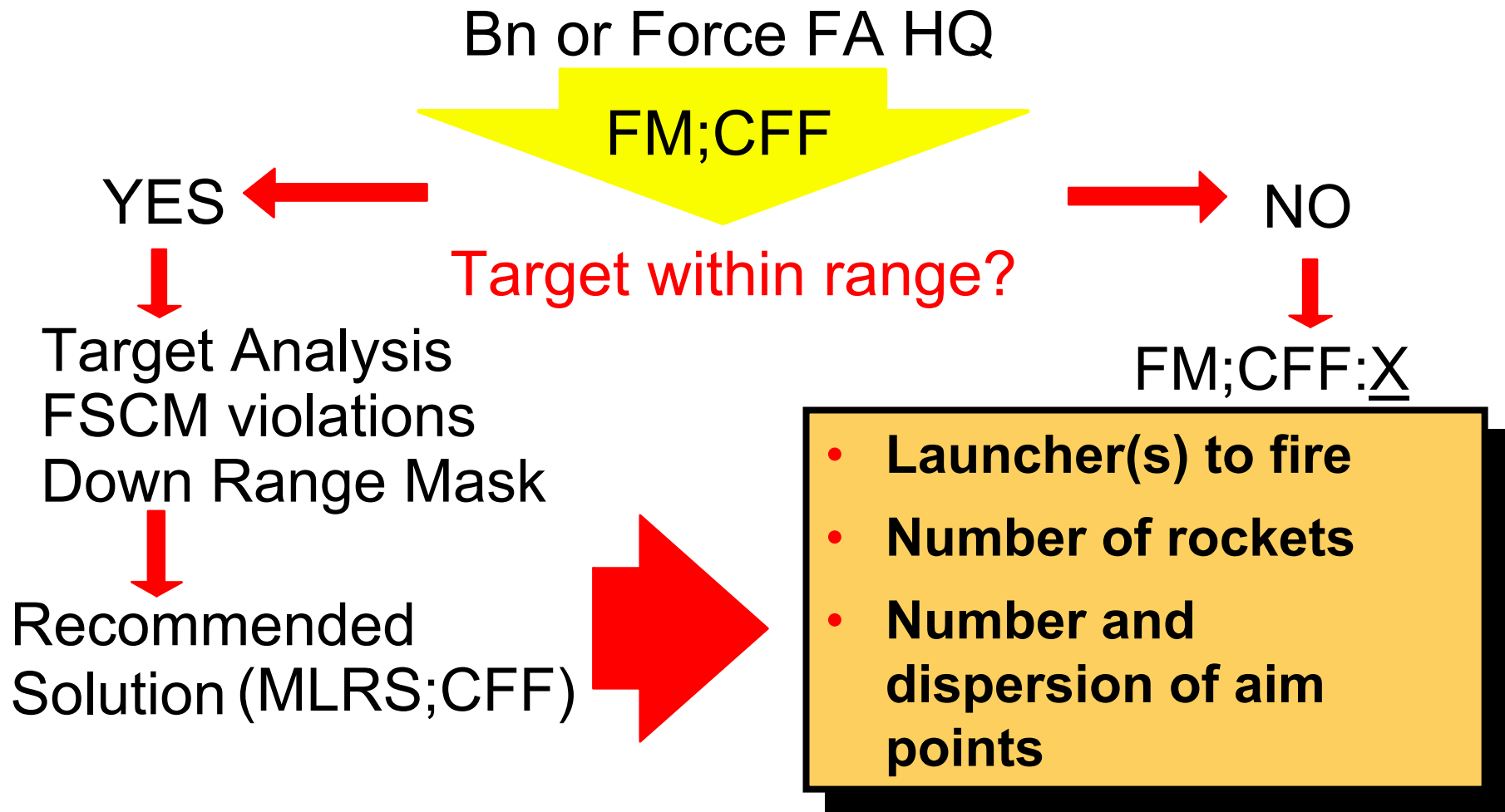 - Target size
  - Range to target

Effects Type Target

- FDS rejects mission when:

  - Percent effects cannot be achieved

  - More than max number of rockets are required to achieve desired effects

Effects Cut-off Factor (ECOF)

- Specifies the minimum percentage of effects that the commander considers acceptable on a fire mission:

  - FDS begins with one round

  - It then adds one round at a time comparing the effects each time

  - When an additional round does not increase the effects by ECOF, effects processing is terminated

Fire Mission Cycle (Battery)

Bn or Force FA HQ

FM;CFF

YES ← → NO

Target within range?

Target Analysis
FSCM violations
Down Range Mask

FM;CFF:<u>X</u>

Recommended
Solution (MLRS;CFF)

- **Launcher(s) to fire**
- **Number of rockets**
- **Number and dispersion of aim points**

Mission Assignment Criteria

- BOC receives and plots the target, consults Cdr's Criteria, xmits mission
- Assigns mission to launcher based on:
  - Firing Point Location
  - Munitions on SPLL and HEMTTs
  - Down Range Mask
  - Launcher status and location
  - FSCM

Launcher Response

- Launcher receives fire mission
- Launcher FCS verifies
- Mission can be fired after consistency check
- Launcher has correct type and amount of munitions
- Target is within range
- Sends "WILCO" message to battery

Movement to Firing Point

- Launcher moves to Firing Point
- Verifies no immediate masks present
- Orients on parking heading within 100 mils
- Position SPLL within 150m of FP
- Lays launcher, arms munitions, FIRES!
- Stows LLM
- Moves to next location

# Multiple FM Sequence
Resource Limitations

- Number of targets excessive
- Limited launcher availability
- Crew can fire up to three missions
  - BOC assigns two targets to same FP
  - FCS recognizes multiple Fire Missions
  - Launcher automatically lays on second target, crew will ARM/FIRE rockets IAW specified method of control

Methods of Control

Methods of Control

FDC Methods	→	SPLL Methods
WR	→	FWR TWR
AMC	→	AMC
TOT	→	TOT TTT
TTF	→	TTF
ONC	→	ONC
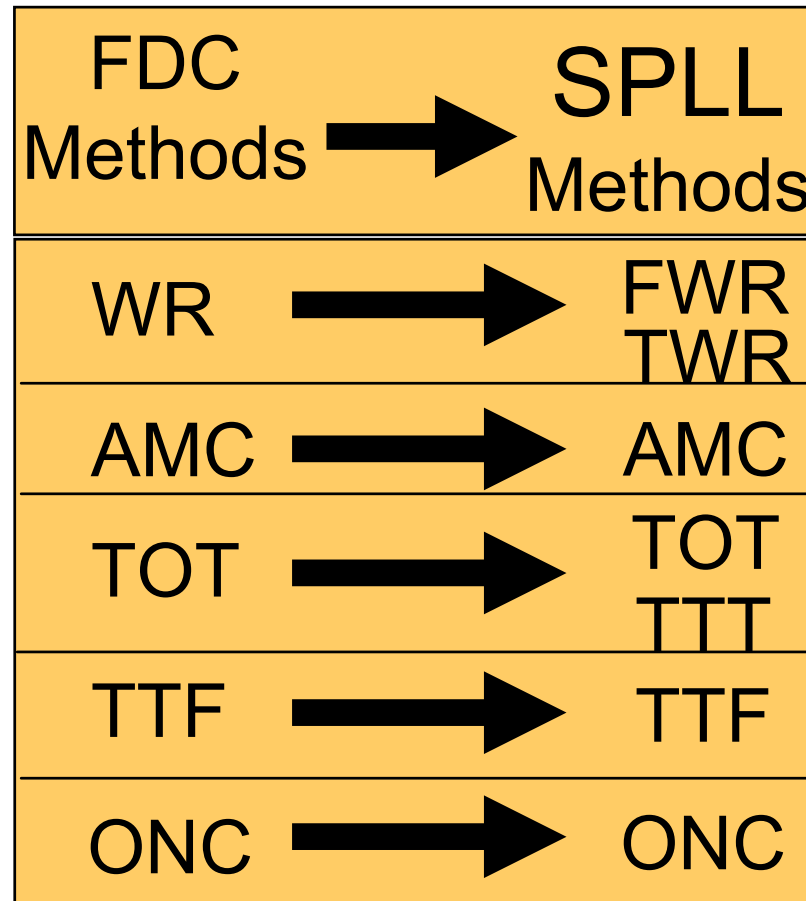
FDC When Ready (WR)

- Mostly likely used to fire opportunity targets, such as enemy artillery

- Launcher fires mission as soon as possible upon receipt of mission

FDC At My Command (AMC)

- Used to fire at moving targets, like enemy entering the breach

- Also, used during "Stay Hot, Shoot Fast"

- Launcher fires mission upon receipt of digital / voice "Fire Command"

FDC Time on Target (TOT)

- Most often associated with Fire Plans

- Used to support SEAD

- Munitions impact on target at designated time

FDC Time to Fire (TTF)

- Most likely used to disrupt radars
- Literally, the time the launcher is to fire the mission

SPLL Fire When Ready (FWR)

- Launcher receives fire mission from FDC
- Moves to firing point
- Fires munitions once launcher is layed

SPLL Timed When Ready (TWR)

- Timed window for launch

- Offers launcher window of opportunity to fire mission

- Most likely used on stationary targets

- Uses 4 countdown clocks:

  - NET and NLT for parking

  - NET Time and NLT time for firing

SPLL At My Command (AMC)

- Launcher lays on target and fires upon FDC's fire command

- FDC sends fire command digital or voice

- Launcher can fire without digital command

SPLL Time on Target (TOT)

- Timed effects on target
- Launcher firing time based on subtraction of time of flight
- Uses 2 countdown clocks:
  - NLT for parking
  - NLT time for firing

SPLL Timed Time on Target (TTT)

- Timed window for warhead event
- Launcher firing time based on subtraction of time of flight
- Most likely used for raid missions
- Uses 4 countdown clocks:
  - NET and NLT for parking
  - NET Time and NLT time for firing

SPLL Time to Fire (TTF)

- Launcher fires munitions at a specific time
- Time of flight is not accounted for
- Uses 2 countdown clocks:
 - NLT for parking
  - NET time for firing

Multiple Missions

- FDC sends fire mission to a launcher
- Launcher lays on target; sends "Ready"
- If the FDC receives another fire mission, it may send it to the ready launcher if:
  - Processing / Transmission times
  - Geometry calculations
  - Time of fire for all rockets
  - Stowing time
  - Does not violate launcher's dwell time

Launcher Fire Mission Processing

Pressing ALM ACK initiates a consistency check or check summary
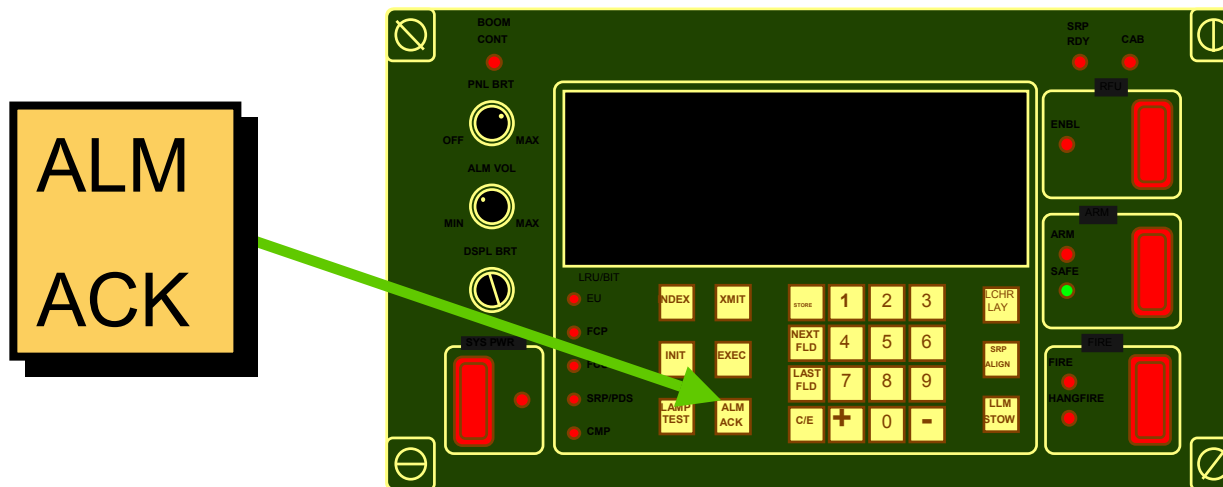
Initial Fire Mission Processing

- Sufficient Weapons (Rocket availability)
- Field/subfield consistency
- Estimate range to target
- Compute park headings
- Stores time between rounds
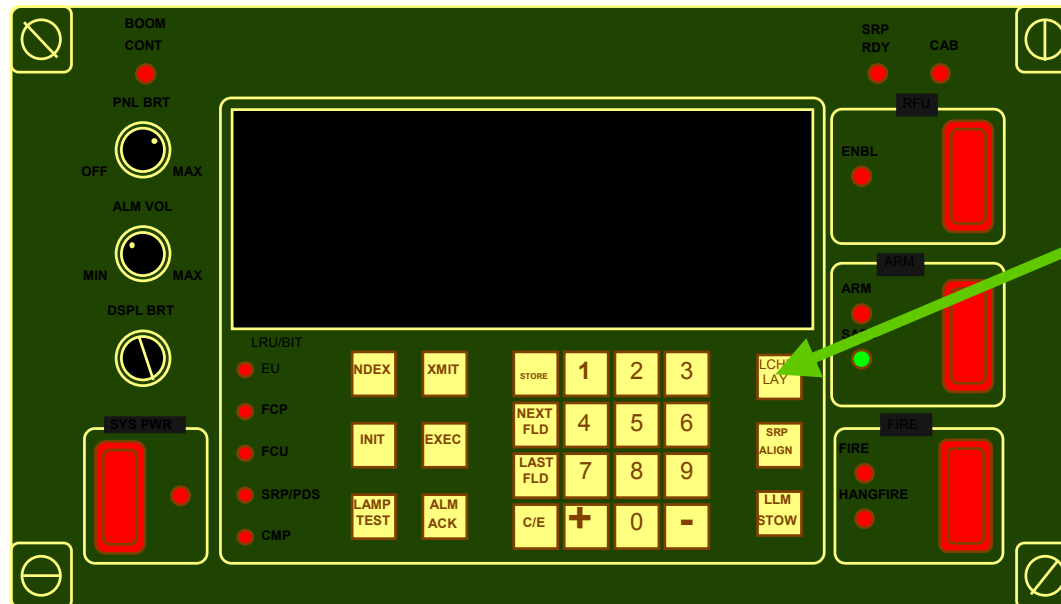- Estimates time of flight

Firing Summary

```
HDG 1603  LOC 6523 0122                    19:42:00
FIRING POINT GRID:A1  6500 0100;

EOM: RELOAD        A1 6400 0300 H104  06  H104  06
METHOD OF FIRE CONTROL: - - - - - - - - - -



PARKING HEADING: 1600 MILS  OR  4800MILS
WHEN PARKED PRESS LCHR LAY
```

Launcher Fire Mission Processing

Pressing LCHR LAY initiates ballistic computations and weapons processing.

LCHR LAY

Firing Summary (cont)

```
HDG 1603  LOC 6523 0122                      19:42:00

LP/C         1:  JED/H104        2:  JED/H104
ROCKETS     6 5 4 3 2 1      1 2 3 4 5 6
STATUS      ■ ■ ■ ■ ■ ■      ■ D ■ ■ ■ ■
SELECTED    ■ X X X X X


AIM POINT     CMD AZ:0010.0  QE:0420.0  FUZE
   1 OF 2     ACTL AZ:0009.0  QE:0421.0  063.0
```
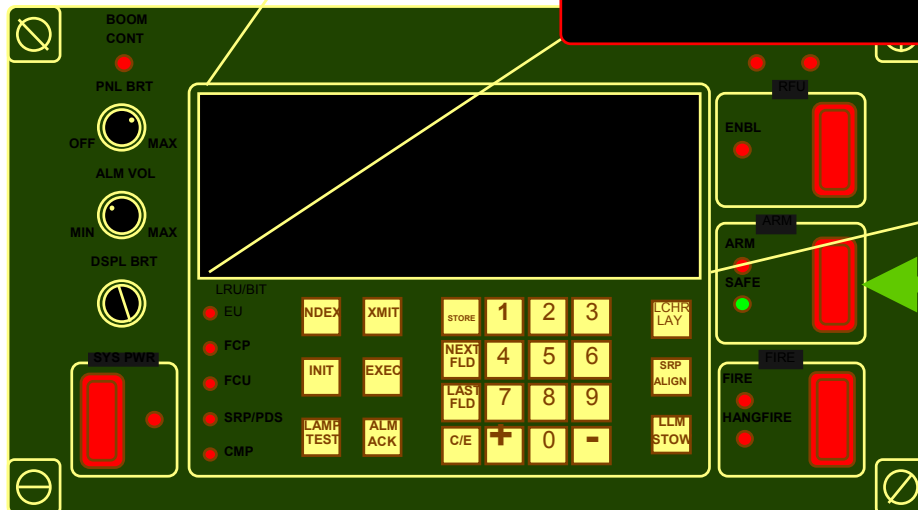
Arming

HDG 1603 LOC 6523 0122   19:42:00
LP/C   1: JED/H104   2: JED/H104
ROCKETS   6 5 4 3 2 1   1 2 3 4 5 6
STATUS   ■ X X X X X   ■ D ■ ■ ■ ■
SELECTED ■ X X X X X

AIM POINT   CMD AZ:0010.0 QE:0420.0 FUZE
   1 OF 2   ACTL AZ:0009.0 QE:0421.0 063.0

ARM ROCKETS

ARM Switch

Firing

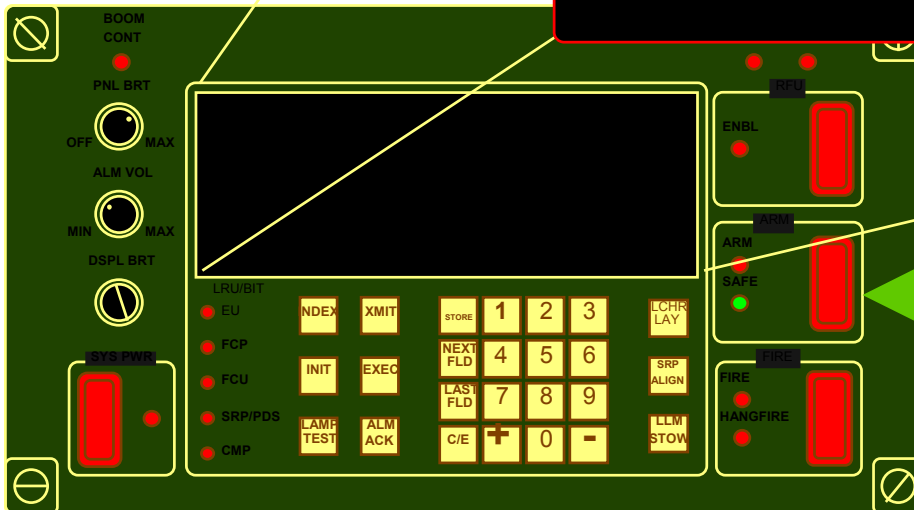HDG 1603 LOC 6523 0122   19:42:00
LP/C   1: JED/H104   2: JED/H104
ROCKETS   6 5 4 3 2 1   1 2 3 4 5 6
STATUS   ■ ■ ■ ■ ■ ■   ■ ᴰ ■ ■ ■ ■
SELECTED   ■   X X X X X

AIM POINT   CMD AZ:0010.0 QE:0420.0 FUZE
    1 OF 2   ACTL AZ:0009.0 QE:0421.0   063.0

FIRE ROCKETS

BOOM
CONT

PNL BRT

OFF   MAX

ALM VOL

MIN   MAX

DSPL BRT

SYS PWR

LRU/BIT
EU
FCP
FCU
SRP/PDS
CMP

NDEX XMIT

INIT EXEC

LAMP ALM
TEST ACK

STORE 1 2 3

NEXT 4 5 6
FLD

LAST 7 8 9
FLD

C/E ✚ 0 ▬

LCHR
LAY

SRP
ALIGN

LLM
STOW

RFU

ENBL

ARM

ARM

SAFE

FIRE

FIRE

HANGFIRE

FIRE Switch

Weapon Malfunctions

D   Dud Fuze

M   Misfire

P   PIM Related Failure

W   Weapon Related Malfunction

H   HANGFIRE

Hangfire

- HANGFIRE light flashes

- "H" appears in status line
  - Crew ensures cab is safe/sealed
  - Crew waits for 30 minutes
  - Gunner sets ARM switch to safe
  - Gunner Stows LLM
  - Move to unloading site

Safety

Safety

- Responsibilities

- Procedures

- Downrange Masks

Appendix "J"

Responsibilities

- Range Safety Officer
- Commander
- Officer in Charge (OIC)
- Operations Officer
- Platoon Leader
- Section Chief

Safety Procedures

- Data Entry
- FCS Self Tests
- Location Data
- Operator Error

Computation of Safety Data

- Safety Computation Methods
  - OPAREA
  - Firing Point
  - Point to Point
- Down Range Masks
- Airspace Coordination

Bias and Precision Errors

Bias errors affect all rockets of a mission and are "occasion to occasion" errors
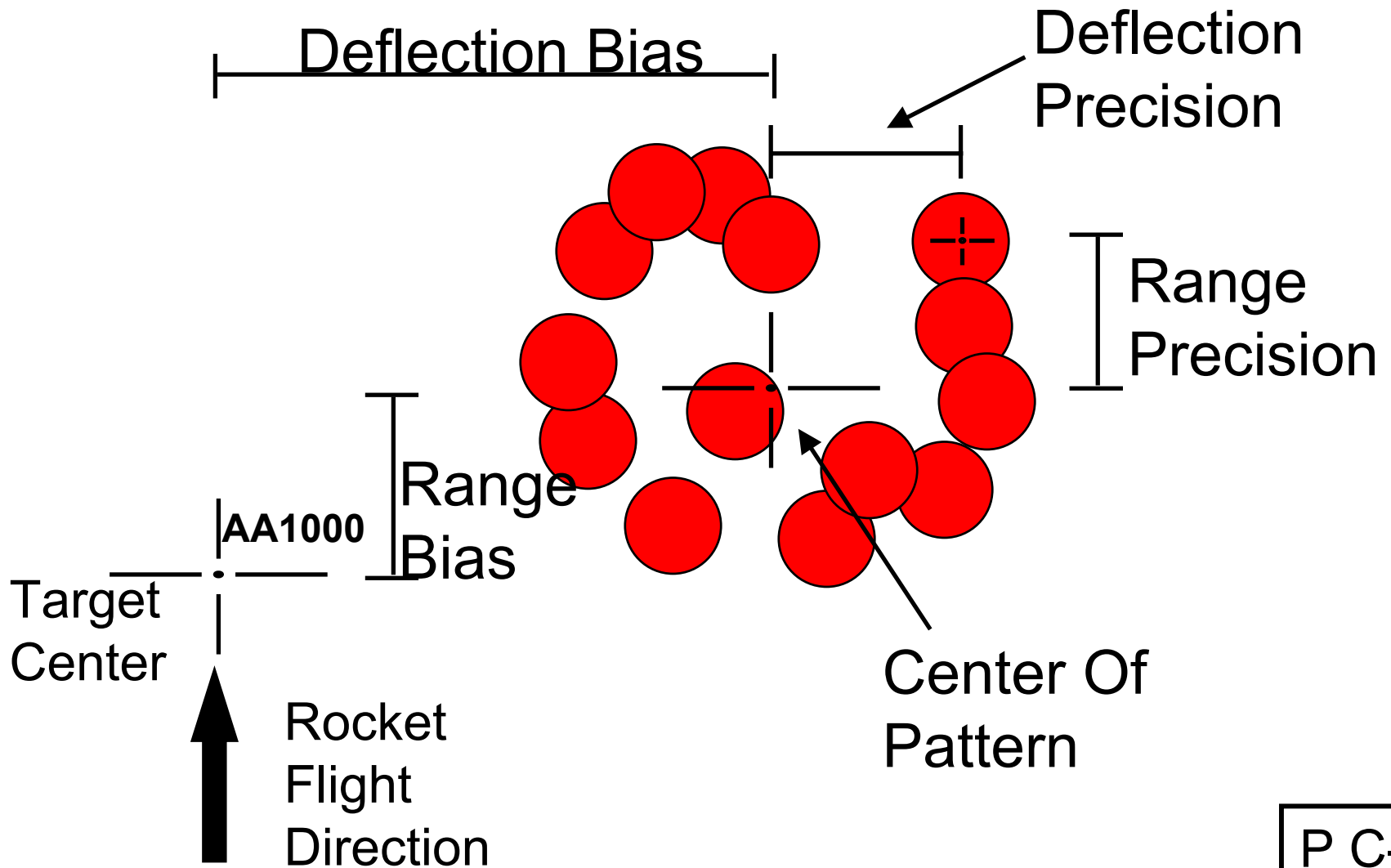
- Examples: errors in measurement of wind speed or direction, errors in measurement of air density.

Precision errors are caused by variations between rockets and differ for each rocket

- Examples include: Variation in launch weight, variation in rocket motor total impulse.

Bias and Precision Errors

Deflection Bias

Deflection
Precision

Range
Precision

Range
Bias

AA1000

Target
Center

Center Of
Pattern

Rocket
Flight
Direction

P C-2

Down Range Masks

- Masks are terrain features that have enough altitude to potentially affect trajectory of rocket or missile.

- Immediate Mask: 2000 m from firing point.

  - Section Chiefs' responsibility

- Down Range Mask: Greater than 2000 m from firing point.

  - Ops Officer / Plt Ldr's responsibility

Accounting for Masks

- Immediate Masks:

  - Use M2 compass and enter in FCS.

- Down Range Masks:

 - Use Crest Clearance Tables (App " H")

  - Use automated checks in LCU

Crest Clearance Tables

- Allows leaders to establish minimum planning range
- Boxes of area that cannot be attacked beyond crest

Automated Down Range Mask

- Entered in the FDS as 3D boxes around terrain feature

- FDS uses input to determine tactical fire direction solution

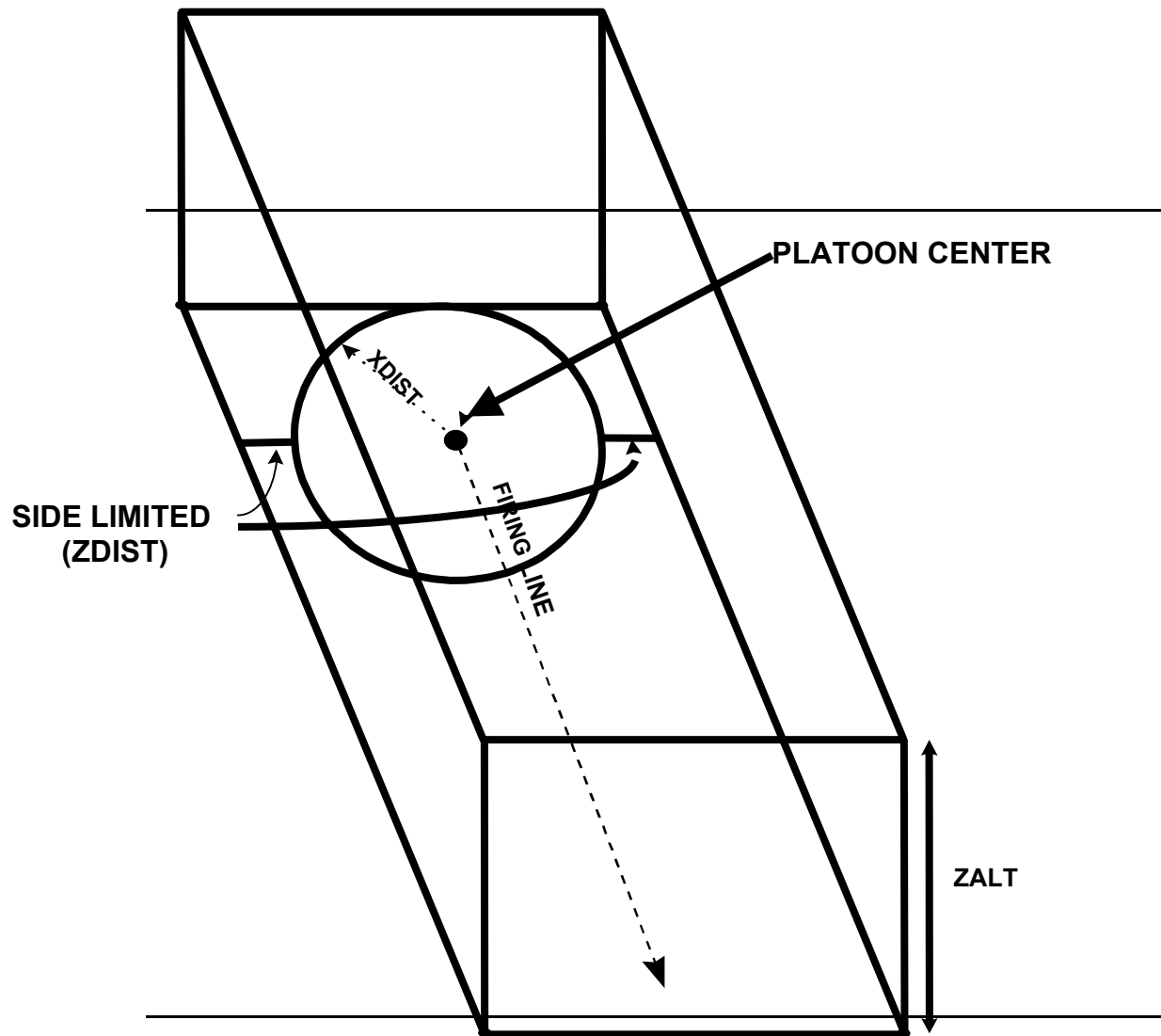- Consideration is loss of some area to fire through

Automated Down Range Masks

Grid

Width

306 m

Grid

OPAREA
A

AOF
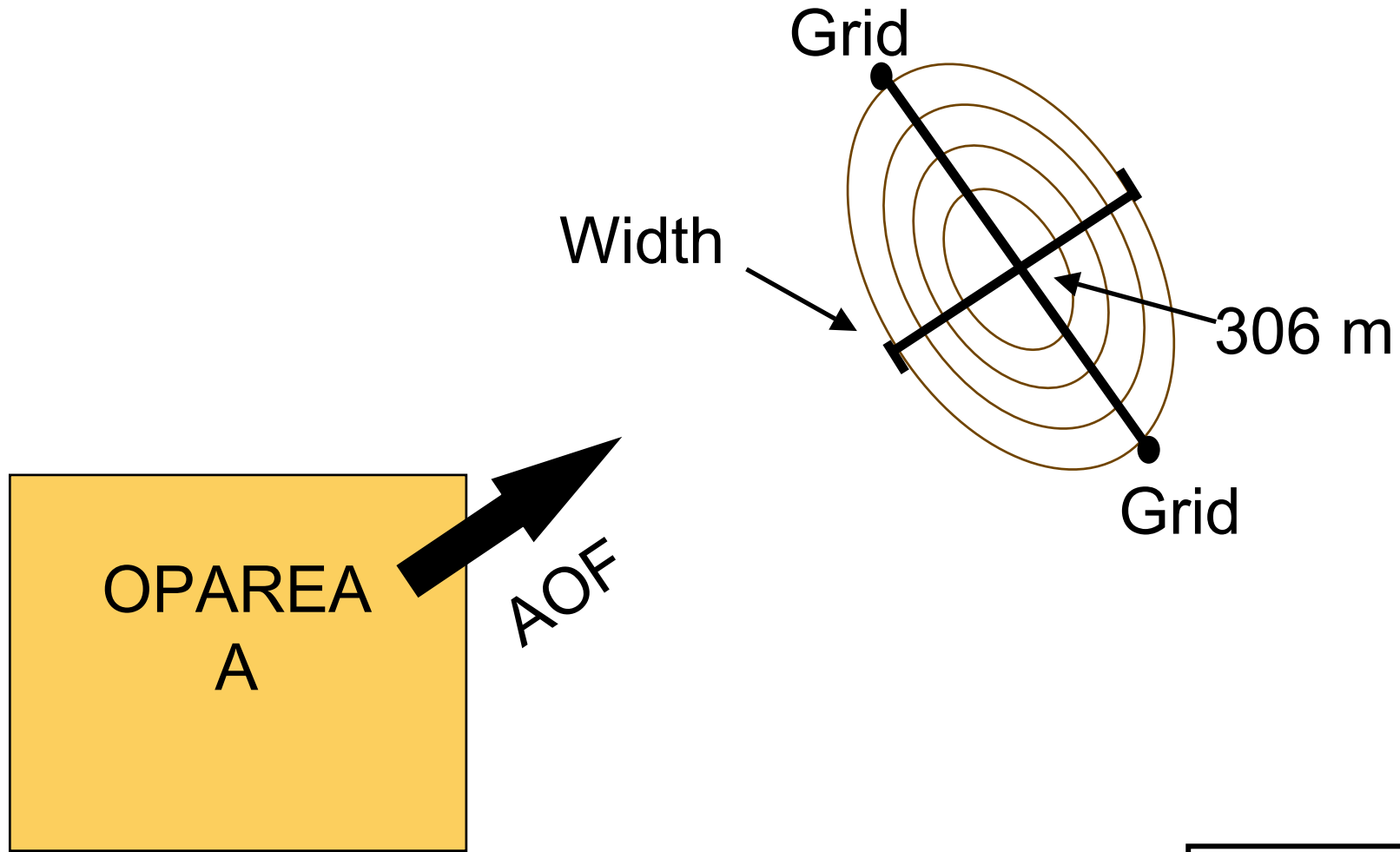
Air Space Coordination

(Restricted Operating Zone)

- Platoon Air Hazard (PAH)
- Target Air Hazard (TAH)

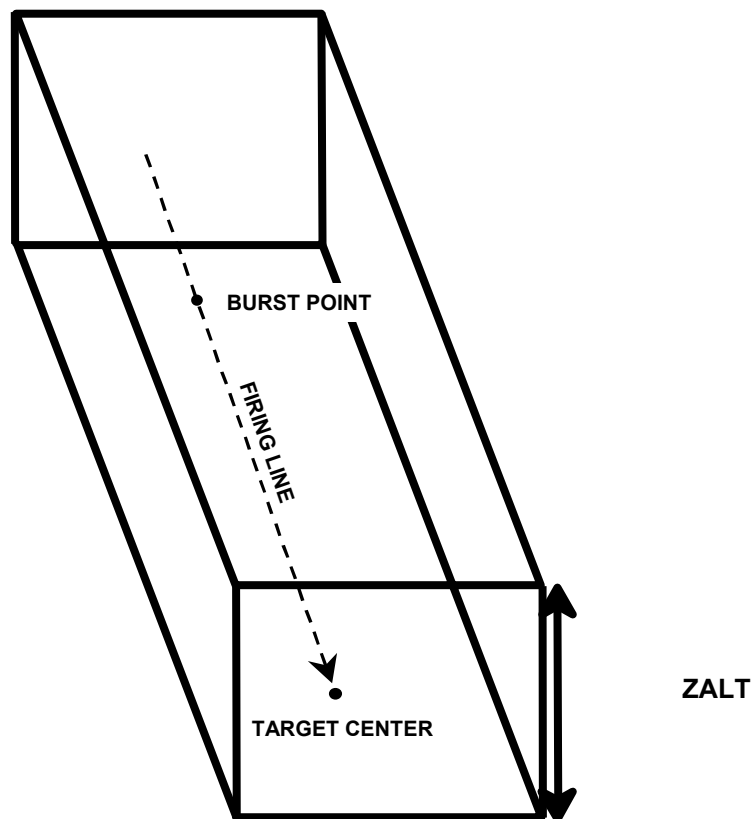- Another reason why accurate launcher location is important!

Platoon Air Hazard (PAH)

PLATOON CENTER

XDIST

SIDE LIMITED
(ZDIST)

FIRING LINE

ZALT

ST 6-60-30

Target Air Hazard (TAH)

BURST POINT

FIRING LINE

ZALT

TARGET CENTER

BLOCK IA ONLY

ST 6-60-30

Summary

- Targeting Process
- Levels of Intensity
- Launcher Location
- Tactical Response Posture
- Meteorological Requirements
- Fire Mission Processing
- MLRS Safety Procedures

Gunnery Department
MLRS Division

"Standards Start Here"